THE OPEN ECONOMY: EXCHANGE RATES

Objectives:

- To understand the determinants of exchange rates in the long-run.
- To understand the purchasing power parity (PPP) and the asset (or interest rate parity, IRP) approaches to explaining movements in exchange rates.

I. Preliminaries: A Review

1. The Nominal Exchange Rate and the Foreign Exchange Market

- The **nominal** exchange rate, denoted as **e**, is the ***price of one currency in terms of another***.

- Specifically, we define the ***nominal spot exchange rate of the Canadian dollar in terms of a foreign currency*** (***e***) as the number of units of the **foreign currency** needed to buy **one Canadian dollar** or, simply: the price of one C$ in the other country's currency (e.g. $US 0.9223)

- In this definition:

  - ***nominal*** means “in terms of money”; the opposite is ***real*** -“in terms of goods and services.”

  - ***spot*** means “for immediate delivery”; the opposite is ***forward*** – “for future delivery.”

- The **Foreign Exchange (FX) Market** is an electronic market, linking banks around the world, on which assets denominated in different currencies are exchanged.

- This market is **huge**: the volume of foreign currency trading is estimated to be 2 trillion (2 000 billion) US dollars a day.

- For comparison, the total value of **international trade** is about 10 trillion US dollars a year.

- So the yearly volume of international trade is equal to **just one week** of foreign exchange transactions.

- Clearly, most transactions on the foreign exchange market are **unrelated to the trade in goods and services.**

2. Flexible and Fixed Exchange rates.

- The responsibility for the exchange rate policy usually rests with the **central bank** (e.g. the Bank of Canada).

- The most important decision is whether the exchange rate system should be **flexible or fixed.**

- An exchange rate arrangement for a country is called a ***flexible exchange rate system*** when the country allows its **exchange rate to be determined in the foreign exchange market.** (e.g. Canadian dollar, US dollar and the Euro.)

- Under a flexible exchange rate system, nominal exchange rates fluctuate from day to day and can change significantly over time. Such changes are referred to as currency appreciations or depreciations defined as follows:

  - ***appreciation***: an increase in the value of the currency (↑***e***) **e.g. the US$ price of one C$ rises.**

  - ***depreciation***: a decrease in the value of the currency (↓***e***) **e.g. the US$ price of one C$ falls**.

- Under a ***pure*** flexible exchange rate system the central bank does **not** undertake transactions on the foreign exchange market; such complete absence from the foreign exchange market is rare.

- Most countries follow a system called a ***dirty float*** (or a ***managed exchange rate***).

- This is an arrangement in which the central bank controls the exchange rate but, at least in principle, it is flexible (e.g. Israel).

- The **instability, or volatility, of flexible exchange rates** is a main reason some countries choose **fixed exchange rates.**

- An exchange rate arrangement is called a ***fixed exchange rate system*** when the country:

  - **sets** the value of the exchange rate at a **certain level**; and

  - its **central bank intervenes** on the foreign exchange markets by buying or selling its currency so as to maintain the fixed value of the exchange rate.

3. The Real Exchange Rate.

3.1 Definition and formula

- The **real** exchange rate, denoted as ε, is the ***relative price of goods in the two countries.***

- Using symbols, the formula for the real exchange rate is:

$$\varepsilon = \frac{eP}{P^*}$$

where: ε is the real exchange rate,

e is the nominal exchange rate (= US$ price of one C$)

P is the price level in Canada in Canadian dollars,

eP is the price level in Canada in **US** dollars,

P^* is the price level in the US in US dollars.

- Thus, ε is the **relative price of domestic (Canadian) goods**.

3.2 Real exchange rate and net exports.

- You can see from equation (1) that the higher is the real exchange rate, the **more expensive** are goods in Canada compared to the US.

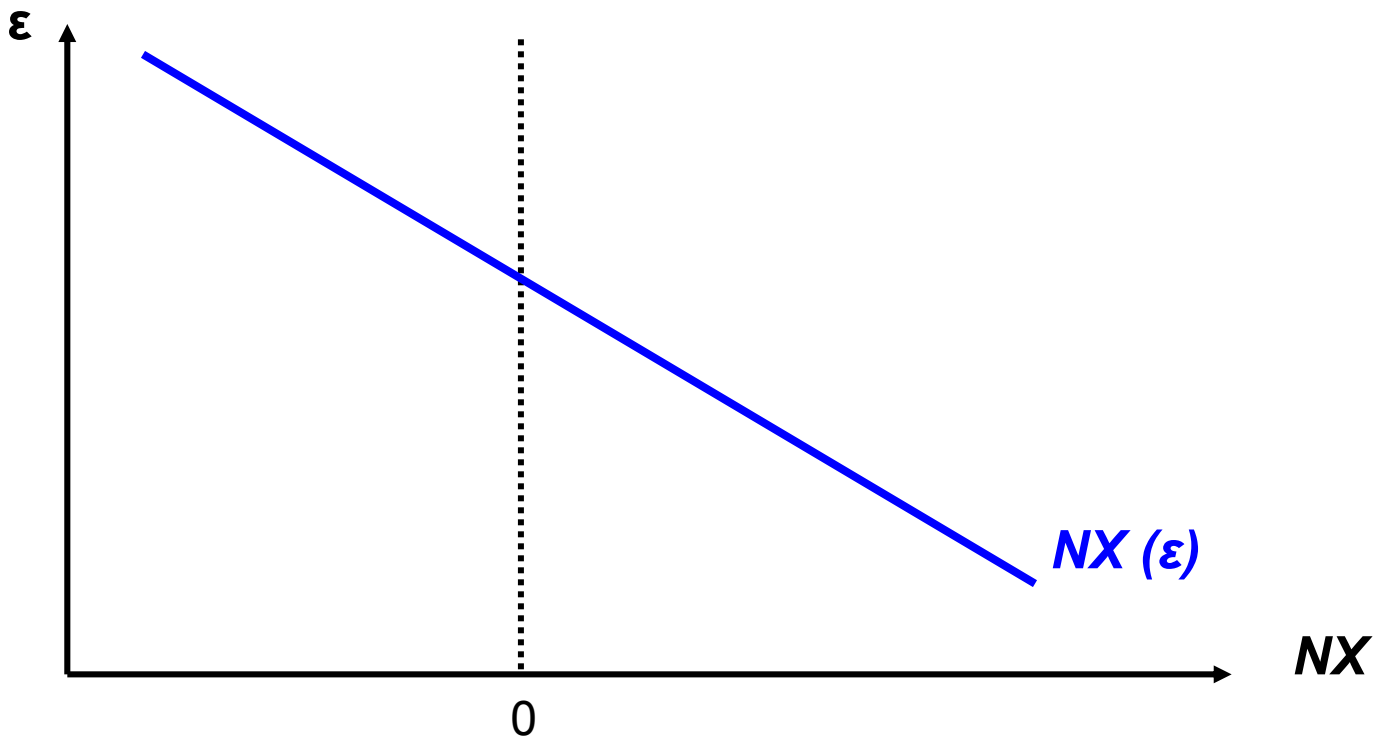
- An increase in the real exchange rate, which increases the relative price of Canadian goods, will **reduce Canadian exports, raise Canadian imports and so reduce net exports:**

$\uparrow \varepsilon \Rightarrow \downarrow EX$ and $\uparrow IM \Rightarrow \downarrow NX$; $\downarrow \varepsilon \Rightarrow \downarrow EX$ and $\downarrow IM \Rightarrow \uparrow NX$

- Net exports are therefore a **decreasing function** of the real exchange rate:

$NX = NX(\varepsilon)$ where: $\uparrow \varepsilon \Rightarrow \downarrow NX$; $\downarrow \varepsilon \Rightarrow \uparrow NX$

- The relationship between net exports and the real exchange rate is shown by the downward-sloping **net exports curve (*NX*)** in Figure 5-8.



II. Exchange Rates in the Long Run: Net Exports and Net Foreign Lending

- We begin by considering the long run determinants of the nominal and real exchange rates between two countries (e.g. Canada and the US) under the assumption that the domestic and foreign price levels (*P, P**) are **constant** and, hence, the real exchange rate (ε) is determined once the nominal exchange rate (*e*) is determined.

- Under a **flexible** exchange rate system the nominal exchange rate (*e*), or US$ price of C$1.0, will be determined at the level required to equate the demand for Canadian dollars and supply of Canadian dollars on the foreign exchange (FX) market.

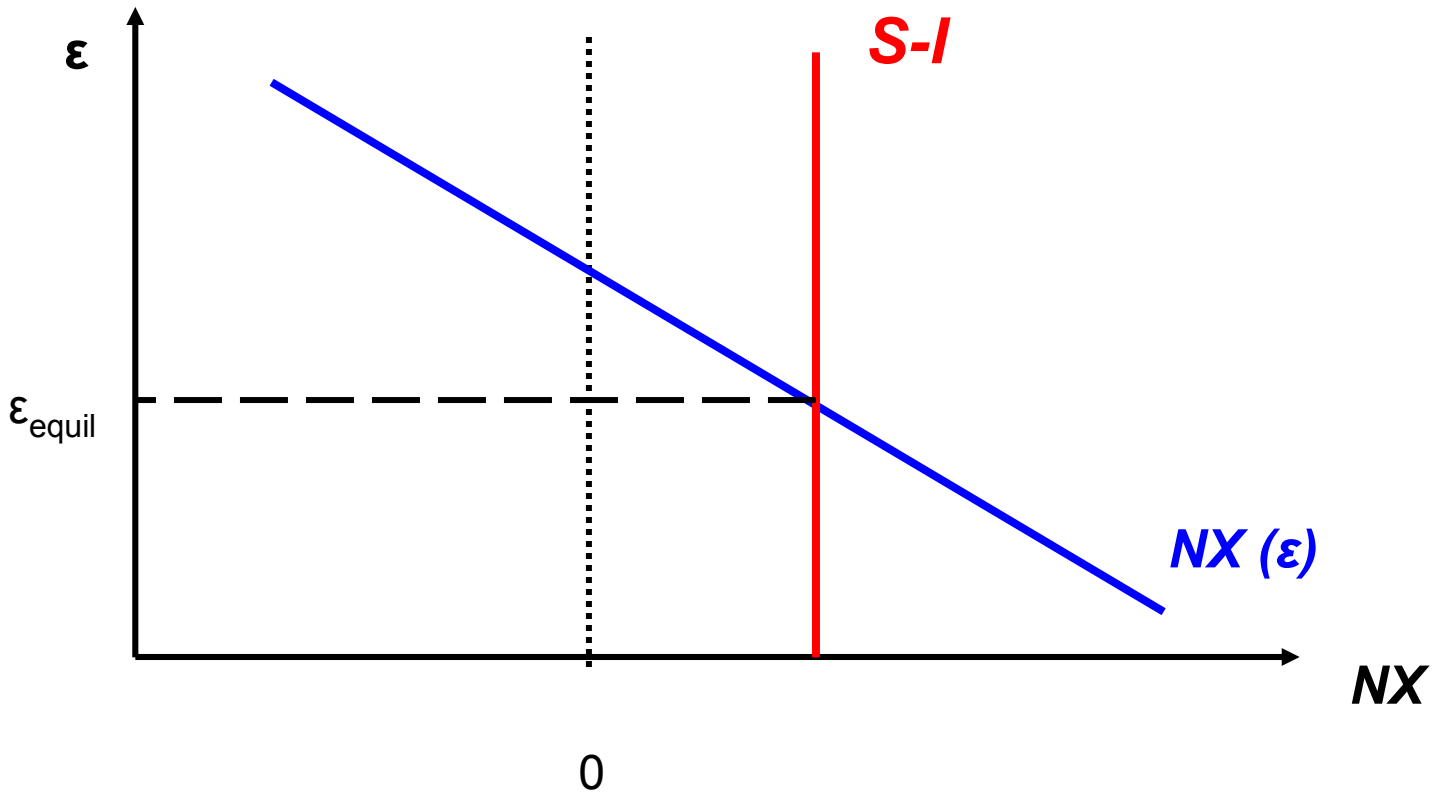
- That equality will occur when Canadian net exports (which give rise to a US demand for C$ on the FX market) equal Canadian net foreign lending (which gives rise to a Canadian supply of C$ on the FX market):

$$NX(\varepsilon) = \overline{S} - I(r^*),$$

where:

$$\varepsilon = \frac{e \cdot P}{P^*}$$

- In Figure 5-9 the equilibrium real (and nominal) exchange rate is determined at the intersection of the vertical line representing the (given) amount of net foreign investment (*S*-*I*) and the net exports curve, $NX(\varepsilon)$.


ε
S-I
ε_{equil}
NX (ε)
NX
0

- At values of the real exchange rate **above** the equilibrium level, Canadian net exports are **less than** Canada's net foreign lending, creating an **excess supply of** Canadian dollars on the foreign exchange market and leading to a **decrease** in both the nominal and real exchange rates which **increases** net exports and, thus, eliminates the excess supply of C$:

NX < *S-I* ✡ excess supply of C$

✡↻e ✡↻ε✡ *NX*, until *NX*=*S-I*

- At values of the real exchange rate **below** the equilibrium level, Canadian net exports **exceed** Canada's net foreign lending, creating an **excess demand** for Canadian dollars on the foreign exchange market and leading to an **increase** in both the nominal and real exchange rates which **lowers** net exports and, thus, eliminates the excess demand for C$:

NX > *S-I* ✡ excess demand for C$

✡e ✡ε✡*NX*, until *NX*=*S-I*

- The equilibrium exchange rate (both nominal and real) will vary with changes in the difference between domestic saving and investment spending (*S*-*I*).

- For example, an **increase** in domestic saving (↑*S*), due to a cut in G or increase in T , or a **decrease** in domestic investment spending (↓*I*), due to a rise in the world interest rate or a decrease in the domestic rate of return to investment, will **increase net foreign lending** (*S*-*I*) and **reduce the equilibrium exchange rate:**

$$\uparrow(S\text{-}I) \Rightarrow \downarrow e \Rightarrow \downarrow \varepsilon$$

III. Exchange Rates in the Long Run: The Special Case of Purchasing-Power Parity

1. Overview

- The ***Purchasing-Power Parity (PPP)*** theory of the exchange rate only deals with **long run** (many years); it cannot explain day-to-day changes in the exchange rates;

- There are two theories: ***Absolute PPP and Relative PPP***; while most people think of Absolute PPP, the Relative version better fits the facts.

- ***Basic Idea: Nominal exchange rates will adjust to ensure that goods cost the <u>same</u> in different countries (<u>absolute</u> PPP) or to ensure that international differences in the cost of goods remain <u>constant</u> (<u>relative</u> PPP).***

2. The Theoretical Foundation of PPP: The Law of One Price.

- Suppose that two countries (Canada and USA) produce and sell an identical good, which we will call good *i,* under the following conditions:

  (a) good *i* is tradeable: it can be exported or imported by either country;
  (b) the cost of transporting good *i* between Canada and the US is zero;
  (c) there are no obstacles to trade in good *i* (no tariffs, quotas, or regulations);
  (d) the Canadian and US markets for good *i* are equally competitive.

- Given these assumptions, good *i* should **cost the same in both countries** when priced in the same currency (in this case US$), and hence:

$$ep_i = p_i^* \qquad (2)$$

Here:

e denotes the nominal exchange rate, or the price of C$1.00 in US dollars,
p_i denotes the price of good *i* in Canada in C$,
ep_i is the price of good *i* in Canada in **US$**,
p_i^* denotes the price of good *i* in the US in US$.

- If good *i* is initially **cheaper in the US** than in Canada ($ep_i > p_i^*$), and the conditions for the law of one price hold, Canadian buyers will **import the good from the US** and, given the nominal exchange rate, Canadian producers will have to lower p_i to meet the price of the US imports, thus equalizing prices: $ep_i = p_i^*$.

- If good *i* is initially **more expensive in the US** than in Canada ($ep_i < p_i^*$), and the conditions for the law of one price hold, US buyers will import the good **from Canada, a**nd, given the nominal exchange rate, US producers will have to lower p_i^* to meet the price of Canadian imports, thus equalizing prices: $ep_i = p_i^*$

- The process of taking advantage of price differences between countries is called **arbitrage.**

3. Absolute PPP and Nominal Exchange rate Determination

- The theory of PPP applies the logic of the Law of One Price to the determination of exchange rates (both nominal and real) between countries which produce a range of tradeable goods.

3.1 The theory of absolute PPP

- Consider two countries (Canada and the United States) which produce the **same** goods in the **same** proportions.

- Assume further that the conditions required for the operation of the Law of One Price apply in all individual goods markets: all goods are tradeable; there are no transportation costs and no barriers to trade; and all goods markets in the two countries are equally competitive.

- Let *P* denote the **price level** in Canada in Canadian dollars calculated as the weighted average of all individual goods prices (i.e. all p_i.).

- Similarly, *P** denotes the **price level** in the US in US dollars, calculated as the weighted average of all p_i* where the weights are, by assumption, equal to those used in the calculation of *P.*

- ***Then, according to the theory of Absolute PPP, the nominal exchange rate (e) will adjust to equalize prices (measured in US$) between Canada and the US and establish purchasing power parity such that*:**

$$eP=P^* \qquad (3)$$

- Dividing both sides of equation (3) by the price level in Canada we obtain a **formula for the (nominal) exchange rate consistent with *PPP***:

$$e = \frac{P^*}{P} \qquad (4)$$

- Equation (4) says that, if absolute purchasing power parity holds, the spot nominal exchange rate is simply **equal to the ratio of price levels in the two countries.**

- An implication of this result is that when absolute purchasing power parity holds, the **real exchange rate (ε) is equal to 1. 0:**

$$\text{When } e = \frac{P^*}{P}, \text{ then } \varepsilon = \frac{eP}{P^*} = \frac{P^*P}{PP^*} = 1.0$$

- How is Absolute PPP established? First consider what would happen if all goods prices were **higher in Canada** than in the US: $eP > P^*$

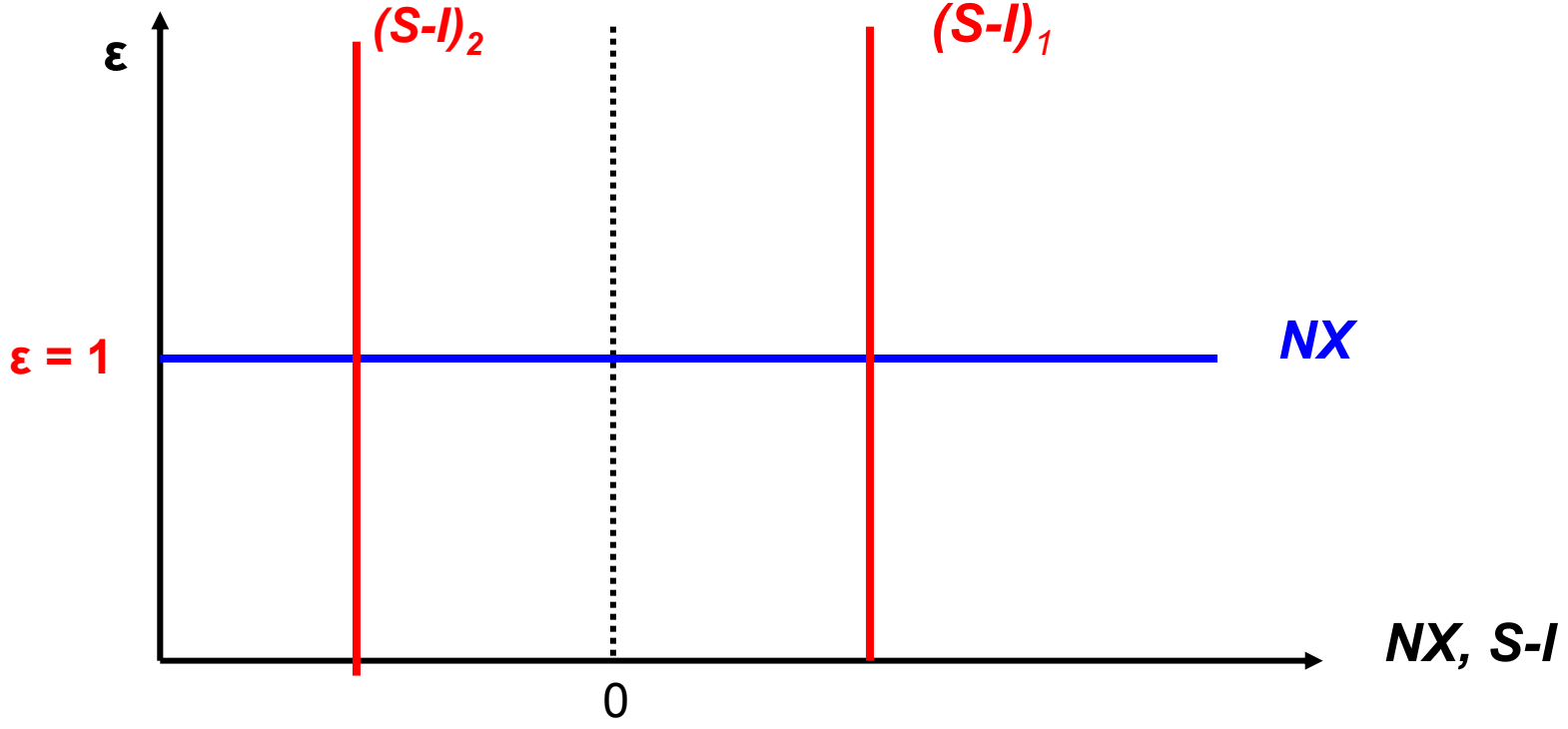
- Then Canadian buyers would take advantage of lower US prices by **buying US imports** which would create an **excess supply** of Canadian dollars on the foreign exchange market and a **fall in the nominal exchange rate** until PPP is achieved:

$eP > P^* \Rightarrow e$ until $eP = P^*$

- Now consider what would happen if goods prices were **lower in Canada** than in the US ($eP<P^*$). Then US buyers would purchase **Canadian imports** creating an **excess demand** for C$ which would **raise the nominal exchange rate** until PPP was achieved:

$eP<P^* \Rightarrow e$ until $eP=P^*$

- The theory of absolute PPP is a special case of our more general theory of long run exchange rate determination in which the net exports curve is **perfectly elastic (flat) at a real exchange rate of 1.0**. There is thus only one possible long-run equilibrium value of the real exchange rate (ε =1.0) no matter what the amount of net foreign lending (*S-I*).



3.2 The empirical evidence

- The empirical evidence suggests that **absolute** PPP does **not** hold exactly even in the long run, although it works better amongst advanced economies (e.g. US, western Europe, Japan and Australia) than it does in comparisons of high-income economies with lower income ones (e.g. Canada and China).

- Why doesn't absolute PPP hold?

(a) Most goods are not tradable.

- Examples of important nontradables: housing, transportation services, wholesale trade services, advertising, retail services.

- The last is very important! When you buy a good the price of the product reflects more than its manufacturing cost. So it is not surprising that retail prices differ across countries (e.g. Japanese cameras are more expensive in Tokyo than in New York because the costs of wholesale and retail services, including rent, are much higher in Tokyo and the retail price is higher.)

(b) Costs of transportation are high for many goods.

(c) There are obstacles to trade

- If the trade restriction is a tariff, the price will obviously differ by an amount similar to a tariff.
- If the trade restriction is a quota or a technical specification, arbitrage is not possible.

(d) Market conditions vary and products differ.

- If there are differences in the competitiveness of the market retailers will have different markups (lower in the more competitive market) and prices will differ.
- If (foreign and domestic) goods are not perfectly substitutable, and buyer tastes differ, then prices need not be equalized.

(e) Different countries produce different goods and in different proportions

- Even if prices are equalized for all individual goods the nominal exchange rate may not equal the ratio of foreign and domestic price levels because of differences in the composition of the “baskets” of goods and services used to construct these measures of the price level.

4 . Relative Purchasing Power Parity.

4.1 Overview

- ***Basic Idea for Relative PPP: international price differences exist but remain <u>constant</u> over time as nominal exchange rates adjust to offset international differences in price inflation***.

- So, for example, if prices of goods and services in Switzerland are 30% higher than prices for goods and services in Canada (when converted into Swiss francs), they should stay 30% higher.

- This means that if there is a difference between the rates of inflation in Switzerland and Canada the nominal exchange (number of Swiss francs per C$1.0) will adjust to reflect such differences and to maintain a constant value for the real exchange rate between Canada and Switzerland.

- How does **relative** PPP differ from **absolute** PPP? Both absolute PPP and relative PPP predict long-run constancy of the real exchange rate but relative PPP does **not** require that ε be constant at 1.0.

4.2 Numerical example.

- Suppose that in 2008 the price level in Canada is P=100, while the price level in the US is P^*=80. In other words, in 2008 a basket of goods that costs 100 Canadian dollars in Canada costs US$80 in the US.

- Suppose the 2008 **nominal** exchange rate is e_{2008} =0.90. This means that the **real** exchange rate is

$$\varepsilon = \frac{eP}{P^*} = \frac{0.90 \times 100}{80} = 1.125$$

- Goods are, on the average, 12.5% **more expensive** in Canada than in the US.

- Suppose that between 2008 and 2009, the rate of inflation in Canada is 2%, while the rate of inflation in the US is 3%.

- This means that in 2009 the price levels in Canada and the US will be

$$P_{2009}=100(1+0.02) = C\$102.0$$
$$P^*_{2009} = 80(1+0.03)= US\$82.40$$

- **If relative purchasing power parity holds, the nominal exchange rate in 2009 should be: $e_{2009}= 0.909$.**

- How did we get this? Under relative purchasing power parity, goods **will remain 12.5 % more expensive in Canada** than in the US in 2009.

- To remain 12.5% more expensive in Canada, the US basket of goods which in 2009 cost US$82.4 must cost the equivalent of $US 82.4·1.125 = $US92.7 in Canada.

- If the basket **actually** costs C$102.0 in Canada in 2009 the 2009 exchange rate must be e=92.7/102.0 =0.909.

- Notice that the 1.0 percentage point difference between the US rate of inflation (3%) and the rate of inflation in Canada (2%) has been offset by a 1.0 percentage point rise in the nominal exchange rate (from 0.90 to 0.909) thus keeping the real exchange rate constant.

4.3 A formula for changes in nominal exchange rates under relative PPP:

- Given

$$\varepsilon = \frac{eP^*}{P}$$

The real exchange rate (ε) will remain **constant**, if and only if, the **ratio on the right of the equation is constant** which will be the case when :

% Change in e + % Change in P = % Change in P^*

Or, % Change in e = % Change in P^* - % Change in P

$$\%\Delta e = \pi^* - \pi$$

- ***Relative PPP says that the rate of change of the nominal exchange rate equals the difference between the foreign rate of inflation (π^*) and the domestic rate of inflation (π).***

- $\pi^* > \pi$ ✡ $\%\Delta e > 0$ ✡ the domestic currency **appreciates**

  $\pi^* < \pi$ ✡ $\%\Delta e < 0$ ✡ the domestic currency **depreciates**

- For example, if the US rate of inflation is 5% ($\pi^* = 5\%$) and the Canadian rate of inflation is 2% ($\pi = 2\%$) then the nominal exchange rate (*e*) will rise at an annual rate of 3% - a 3% appreciation in the value of the Canadian dollar.

IV. Explaining Exchange Rates: The Asset (Interest Rate Parity) Approach

1. Overview

- ***Basic Idea: The interest rate parity (IRP) theory of exchange rate determination states that exchange rates adjust to make the expected rates of return on assets denominated in different currencies equal.***

- Under IRP the current (spot) exchange rate between the Canadian and US dollars is determined by three factors: US and Canadian (nominal) interest rates and the expected future rate of change (if any) in the exchange rate between the Canadian and US dollars.

2. The individual investor's decision: a numerical example

- Suppose that on January 1, 2009 a Canadian investor has a certain sum of Canadian dollars which she wishes to invest for one year in an interest-earning asset.

- She has a choice between buying **one-year Canadian government bonds or one-year US government bonds.** Both bonds are risk free.

- Suppose a 1-year **Canadian** bond yields 2.0% interest per year (i = 0.02). Thus, if she buys Canadian bonds then for each dollar so invested she will have, in one year:

$$1+i = \text{C\$1.02}$$

- Alternatively, she can

  (a) sell Canadian dollars and buy **US dollars** at the **current** (January 1, 2009) **spot exchange rate (*e*)**
  (b) immediately use the US dollars to buy 1-year **US bonds**
  (c)when the bonds mature (on January 1, 2010) receive US dollars in payment of principal and interest
  (d) immediately **sell the US dollar proceeds from the bonds and buy Canadian dollars** at the spot exchange rate in effect on January 1, 2010, denoted as e_{+1}.

- Assume the current spot exchange rate (e) is 0.90 and the interest rate on 1-year US bonds is 3.0% ($i^* = 0.03$).

- Then for each C$ the Canadian investor can obtain US$0.90 which can be used to buy US bonds yielding 3% interest. At the end of the year for each Canadian dollar she will have an amount of US dollars equal to

$$e(1+i^*) = 0.90(1.03) = \text{US\$0.927}$$

- She does not know the spot exchange rate a year into the future so she has to form **an expectation of the exchange rate in a year's time, denoted as e^{E}_{+1}.**

- Suppose that the investor expects the Canadian dollar to appreciate by 2% over the year so that: $e^{E}_{+1.} = 0.918$. (The US$ price of C$1.0 rises from 0.90 to 0.918).

- Then for each Canadian dollar invested in US bonds on January 1, 2009 she expects that on January 1, 2010 she will have an amount of **Canadian** dollars equal to

$$\frac{e(1+i^*)}{e^{E}_{+1.}} = \frac{0.90(1.03)}{0.918} = \frac{0.927}{0.918} = \text{C\$1.01 (approx)}$$

- Clearly, in this case the investor will maximize the expected rate of return by buying **Canadian** bonds rather than US bonds:

$$(1+i) > \frac{e(1+i^*)}{e^E_{+1}}$$

$$\text{C\$1.02} > \text{C\$1.01}$$

- If on the other hand, the Canadian investor had expected only a 1% appreciation of the C$ over the year ($e^E_{+1} = 0.909$) then the rates of return on the two bonds would have been approximately equal:

$$(1+i) \leftrightarrows \frac{e(1+i^*)}{e^E_{+1}}$$

$$\text{C\$1.02} \leftrightarrows \frac{0.90(1.03)}{0.909} = \text{C\$1.0198}$$

3. The interest rate parity condition

- Now assume that **all** asset holders face the same choice between holding domestic (Canadian) or foreign (US) bonds and seek to maximize the expected rate of return on their portfolios.

- Assume all asset holders have the **same** expectation of the value of the exchange rate in a year's time (e^{E}_{+1}) and that they hold that expectation with certainty.

- Then, if **both Canadian and US bonds are to be held** they must have the **same** expected rate of return: a condition known as ***interest rate parity***.

- Interest rate parity will prevail when

$$1 + i = \frac{e \cdot (1 + i^*)}{e^E_{+1}} \qquad (5)$$

- ***Interest rate parity exists when one Canadian dollar invested for a year in US bonds has the same expected return as it would if invested in Canadian bonds.***

- For small values of interest rates, equation (5) can be simplified to yield the following approximation:

$$i \approx i^* - \frac{(e^E_{+1} - e)}{e} \qquad (6)$$

- Interest rate parity exists when the rate of return on domestic (Canadian) bonds (i) is equal to the expected rate of return on foreign (US) bonds which equals the world (US) interest rate minus the expected rate of depreciation of the foreign currency (= the expected rate of appreciation of the domestic currency.)

- For example, if Canadian bonds pay 2% interest (i = 0.02) while US bonds pay 3% (i*=0.03) then interest rate parity will prevail if the Canadian dollar is expected to appreciate by 1% over the year:

$$0.02 = 0.03 - \left(\frac{0.909 - 0.90}{0.90}\right), \qquad \text{where: } e = 0.90, \; e^{E}_{+1} = 0.909$$

$$0.02 = 0.03 - 0.01$$

- The intuition is straightforward: If investors expect the Canadian dollar to appreciate relative to the US dollar by 1%, (a 1% depreciation of the US dollar in terms of the Canadian dollar) they will accept a 1% lower interest return on Canadian bonds (2% rather than 3%). The gain in higher interest return on US bonds is exactly offset by the decline in value of the US dollar in terms of Canadian dollars.

4. Using the theory of interest rate parity to explain changes in the nominal exchange rate.

- Suppose that interest rates on US and Canadian bonds are equal at 2% ($i = i^* = 0.02$) and that asset holders expect that the exchange rate in a year's time will be US$0.95 per C$ ($e^E_{+1} = 0.95$).

- Then for interest parity to prevail the current spot exchange rate (e) **must** be 0.95.

- Now suppose the **Canadian interest rate rises to 3%** ($I = 0.03$), with **no** changes in either the US interest rate or the expected future exchange rate.

- Interest rate parity no longer exists: Canadian bonds have a **higher** expected rate of return than US bonds:

$$0.03 > 0.02 - \frac{(0.95 - 0.95)}{0.95} = 0.02$$

- US bond holders will seek to buy Canadian dollars on the FX market in order to buy the higher-yielding Canadian bonds. But that will cause the **current (spot) exchange rate (or US$ price of the C$) to rise to 0.96** (approx) to yield an **expected rate of <u>depreciation</u>** of the C$ over the year of **1%**:

$$0.03 \approx 0.02 - \frac{(0.95 - 0.96)}{0.96} = 0.030416$$

- Now suppose that starting from an initial equilibrium in which $i = i^* = 0.02$ and $e = e^E_{+1} = 0.95$, the **US interest rate rises to 3%** ($i^* = 0.03$), with no changes in either the Canadian interest rate or expected future exchange rate.

- Interest rate parity no longer exists: Canadian bonds have a **lower** expected rate of return than US bonds.

- Canadian bond holders will seek to buy US dollars on the FX market in order to buy the higher-yielding US bonds. But that will cause the **current (spot) exchange rate (or US$ price of the C$) to fall to 0.94** (approx) to yield an **expected rate of <u>appreciation</u> of the C$ over the year of 1%:**

$$0.02 \approx 0.03 - \frac{(0.95 - 0.94)}{0.94} = 0.01936$$

- ***Conclusion: an increase in Canadian interest rates (↑i) leads to an appreciation of the Canadian dollar (e↑) while an increase in the world interest rate (↑i*), leads to a depreciation of the Canadian dollar (↓e).***

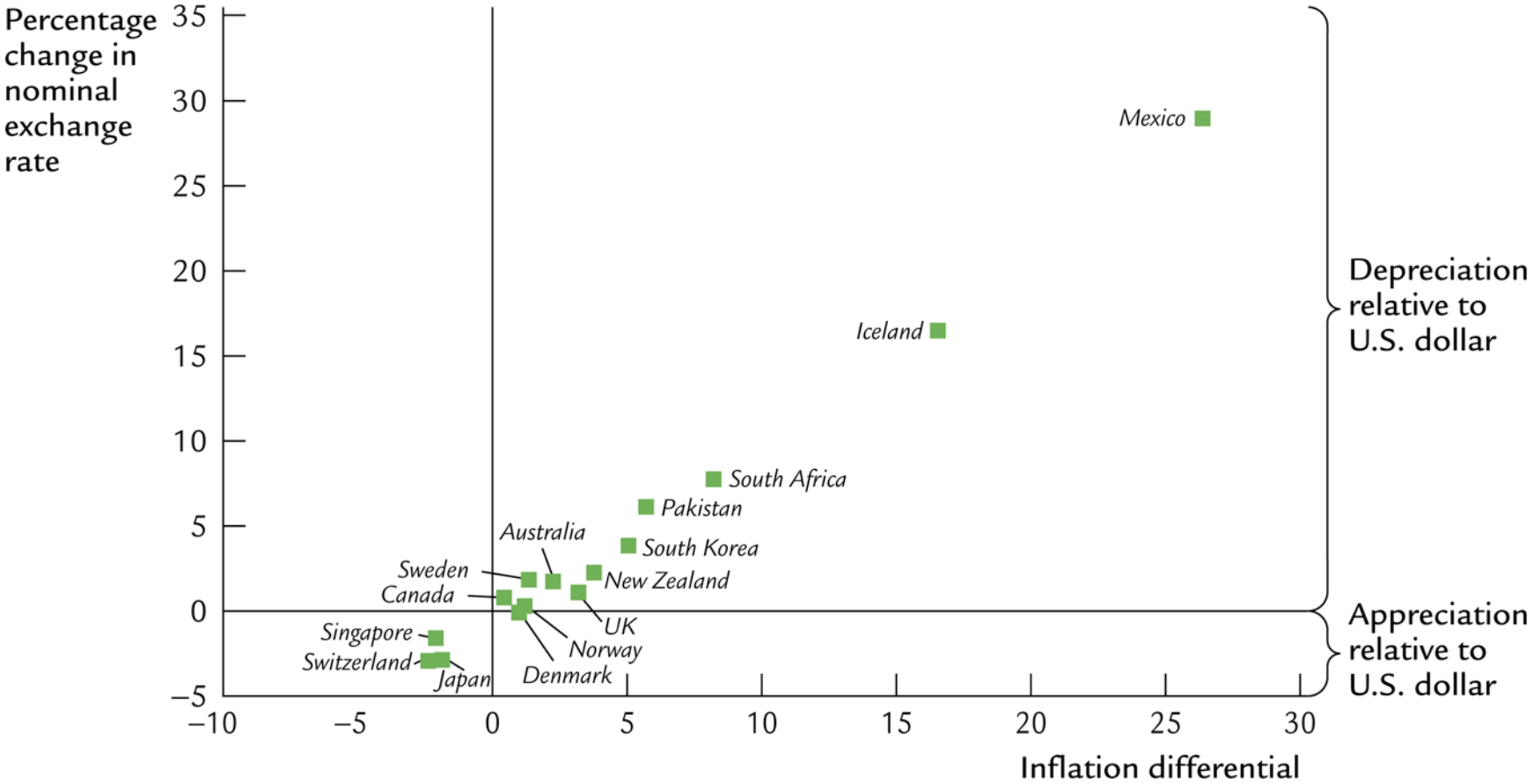


Figure 5.14 Inflation Differentials and the Exchange Rate

TABLE 5-2

Big Mac Prices and the Exchange Rate: An Application of Purchasing-Power Parity

Country	Currency	Price of a Big Mac	Exchange Rate (per U.S. dollar) Predicted	Actual
Indonesia	Rupiah	14,770	4,771	9,654
South Korea	Won	2,498	817	1,003
Chile	Peso	1,496	490	591
Hungary	Forint	532	173	205
Japan	Yen	252	81.7	108
Taiwan	Dollar	75.4	24.5	31.3
Thailand	Baht	60.2	19.6	40.7
Czech Rep.	Koruna	56.6	18.4	24.6
Russia	Ruble	42.1	13.7	28.4
Sweden	Krona	31.4	10.1	7.53
Mexico	Peso	28.1	9.15	10.9
Denmark	Krone	27.9	9.07	6.10
South Africa	Rand	14.2	4.56	6.76
China	Yuan	10.5	3.43	8.28
Egypt	Pound	8.99	2.94	5.80
Poland	Zloty	6.49	2.12	3.31
Switzerland	Franc	6.34	2.06	1.25
Brazil	Real	5.95	1.93	2.49
Malaysia	Ringgit	5.24	1.72	3.80
Argentina	Peso	4.75	1.55	2.90
New Zealand	Dollar	4.45	1.45	1.40
Singapore	Dollar	3.61	1.18	1.66
Canada	Dollar	3.30	1.07	1.26
Australia	Dollar	3.26	1.06	1.30
United States	Dollar	3.06	1.00	1.00
Euro Area	Euro	2.93	0.95	0.82
United Kingdom	Pound	1.89	0.61	0.55

Note: The predicted exchange rate is the exchange rate that would make the price of a Big Mac in that country equal to its price in the United States.
Source: The Economist, June 9, 2005.

Table 5.2

Mankiw and Scarth: Macroeconomics, Canadian Third Edition